A

DISSERTATION

ON

LIGHT AND VISION,

DEFENDED BEFORE THE

MEDICAL SOCIETY OF PHILADELPHIA,

IN THE YEAR 1809.

BY ROBERT H. SMITH.

CINCINNATI:
PRINTED BY JOHN W. BROWNE & CO.
OFFICE OF LIBERTY HALL.
1812.

DISSERTATION, &c.

GENTLEMEN OF THE SOCIETY,

I AM aware of the difficulties before me, when I address a learned and inquisitive assembly upon a subject which has hitherto been the labour of ingenious and philosophic writers. Therefore, since my desire for the improvement of science exceeds my abilities, I shall in this essay depend more on your assured liberality and benevolence, than the true merit of my own performance. For the subject has been so repeatedly ransacked, and placed in such various points of view, that it is not only difficult and hazardous to propose any thing new, but equally so to attempt the improvement of that part which has hitherto been received and taught in the schools: though it is acknowledged there is yet ample field for improvement. Our knowledge of the subject seems to have been stationary for a considerable space of time. I imagine its progress has been slow on account of the real incomprehensibleness of the subject, and still retarded by the unfavourable aspect which has been held up to our view.....the improbability of its ever being extended beyond a certain limitation. This reflection has, I believe, uniformly discouraged many who would otherwise be adventurers in a speculation on this subject. I offer no apology for my own temerity in the case, except a wish of seeing the matter more particularly investigated by one whose genius and wisdom may better qualify him for the task than myself.

Having thus frankly acknowledged the avowed end in view, I proceed, according to my original design, and with a due regard to the difficulties of the task, to make a few strictures on the subject of LIGHT and VISION, the purport and tenet of which shall sufficiently evince, that it was not a consciousness of ability to extend knowledge, or support any new advances on the subject, that brought me hither; but a propensity of acquiring.

In treating the subject of VISION, the first and most essential matter of enquiry is LIGHT; since it is the sole mean by which it is effected; and without correct knowledge of which, hypothesis and ignorance must consequently preside the subject. But in pursuance of this proposition, I am forced to acknowledge, with the general mass of mankind, my ignorance: for in vain has the ingenuity of man for ages been employed in developing this infinitely difficult subject. It does, therefore, seem removed far from the limited views and narrow comprehension of mankind, though they are the most noble and wonderful of all terrestrial beings. But how feeble soever we may be in regard to our comprehension of things, we are endowed with intellectual faculties, in the exercise of which, according to our views of terrestrial affairs, we are led to imagine, that the Supreme Being, as well as ourselves, employs certain means to effect all his purposes.

It appears that HEAT, (which seems to be extremely analagous to LIGHT, and is believed by some to be a modification of it) was employed as a principal agent in the great work of animated nature. This is too obvious to be doubted: for without this element, the earth would exhibit a lifeless mass, vastly contracted in its dimensions, and proportionally increased in density. Many

circumstances render it discoverable that there was a preconceived plan respecting the formation of this earth; as a great variety of principles are designedly heaped together as constituent parts; and as we know each of these to be essentially necessary in its various operations. These heterogeneous matters, uniting in different proportions, and adhering one to another, with different degrees of tenacity, present that wonderful variety in quality and consistence of matter. For the Great Chymist of Nature, having collected together suitable proportions of these constituents, has united them, and what is yet more astonishing, given that union animation. This may very properly be termed the living part of the earth; which is confined exclusively to its surface; which demonstrates decisively the truth of the foregoing position, that LIGHT and HEAT are the principal agents in the various operations of nature. "Organization, sensation, spontaneous motion, and all the operations of life," says Lavoissier, "only exist at the surface of the earth, and in places exposed to the influence of light: without it nature itself would be lifeless and inanimate. By means of light, the benevolence of the Deity hath filled the surface of the earth with organization, sensation and intelligence."

Now it appears, that when the earth was first situated in its orbit, the volatility of all the different principles which compose its atmosphere were wisely adapted to that degree of light and heat by which it was to be enlivened. Those diffusive agents, their judicious unison of action, which is alternated and perpetuated among all the principles of this globe, produces, as we see, composition, decomposition, germination, putrefaction, and the various fermentations which keep this earth in perpetual vibration. And this same degree of heat acting upon

the less volatile part, or that which opposes a greater resistance to its action, causes the different densities of matter with which we are presented. For we find that in almost every instance where heat is expelled from bodies, the density thereof is increased in proportion to the abstraction of heat.

I intimated above, that at first sight, it would appear, light and heat are very nearly allied But how far soever this analogy may seem to extend, it is evident from minute investigation of the two principles, they differ essentially. There does not the least difficulty occur to me in admitting that heat is a latent principle, diffused through all matter; and is made sensible by friction, percussion, chemical attraction, or the action of light. Its agency in the renewal and dissolution of different compounds, and, in fact, the great and conspicuous part it sustains in the astonishing work of creation, certainly depend on the means I have mentioned for its extension. The chief among these is unquestionably light: it seems to be the grand instrument of vitality, as the want of it evidently shews. It therefore appears in my view extremely probable, that if the earth and its appurtenances were removed entirely from under the influence of the great centre of attraction, it would still retain the same quantity of heat and light which originally composed a part of the general mass; & that we would be entirely sensible of it (believing we could exist in such a case) as there would be the same atmosphere, and consequently would be alike perceptible to our senses when extruded by friction, percussion, or any other means. These principles, I doubt not, will be universally rejected; for to abandon the idea of calorific rays in light of the sun, is more difficult than we could at first imagine, since the

reverse of this has been inculcated universally by the most celebrated philosophers, both ancient and modern.

We are apt to be tenacious of early impressions, until palpable absurdities present themselves; we then flounder in uncertainty, until we explore the way to truth. However, if calorific rays do accompany the light of the sun through the atmosphere to the earth, I should be glad to understand how it happens that these rays communicate none of their heat to the medium through which they pass? Here it is answered, that the light of the sun gives no heat to transparent bodies. But if it contains caloric, and heat is brought in contact with the body, I am unable to offer any plausible conjecture why it should not combine with the body, notwithstanding its transparency. But we invariably find that its effects are not produced until it arrives at some opaque body.

The light from a fire seems to be the same as that of the sun, composed of the seven prismatic colours; and this, in its state of combination with caloric, heats and rarifies transparent bodies to ani nfinite extent; but when separated from the heat with which it is blended, as it emanates from the fire, it has no more effect on transparent bodies than light of the sun. Light seems to have a wonderful tendency to combination. This affinity between light and earth may cause the developement of heat. Whatever body the light may chance to fall on, the heat contained in this body is rendered latent by its intimate union with such of the component parts of this mass as it has the strongest affinity for: and as long as the affinity between those two substances prevail, so long will the heat remain latent. But should light,

which may have a stronger affiinty for all matter than heat, come in contact with the body by which heat had been held in a latent state, and exerting this stronger attachment, must of course set the heat at liberty, which then becomes sensible. It is in this way I would account for apparent heat in light of the sun. Indeed I cannot avoid expressing my doubts relative to our earth's receiving even light itself, as astronomers suppose, from the sun, which they believe to be a vast body of fire emitting beams of light. This opinion involves many difficulties which no theory can remove. It is true there are insurmountable difficulties arising out of the other side of the question: nevertheless, it must be acknowledged that a tenacious adherence to the ancient theories of light, does argue a palpable contradiction to one of the most essential points in natural philosophy.

It is an opinion generally received by astronomers, that the regularity of the solar system is supported and perpetuated by mutual attraction and centrifugal force: that there is a just balance between those two powers, for should attraction prevail in the least degree by a diminution of the counteraction, the sun and all the planets of the solar system would consequently be brought in contact. On the contrary, should this power be lessened, so that the projectile force might prevail, the result is equally obvious. We may very fairly infer, that when the solar system was first put into operation, the powers employed for their safety and harmony of co-operation was so exactly adjusted and proportioned as to keep the general system on a true balance. They must preserve uniformly their original allowance of matter, in order that the planets may sustain a compl revolution in

their respective orbits, and the sun preserve its situation in the centre. Now as the force of attraction depends entirely on the quantity of matter embodied, and as this power must be lessened in proportion to the diminution of the attracting body, and as light is known to be a material substance, and the sun is continually dealing out this matter to the different planets, it must be understood that this unrepaired loss of the sun, and uniform accession to the planets, will so materially affect its attractive power as to give the projectile force of the planets the advantage, and thus throw the solar system into disorder. We can conceive of no power acting with suitable force to propel the matter of light through that immense space, from its centre of gravity to the earth, and other planets of the solar system. It is contradictory to imagine that matter can fall from its centre of gravity. It is allowed that the sun is a body towards which all matters gravitate: and if its attraction is so powerful and extensive as to act with such inconceivable force on the planets, which are so large and at such immense distance from it, how improbable does it seem that light (which is of such extreme levity as to give rise to a controversy about its materiality) should come from its centre of gravity with such extraordinary speed as has been computed by philosophers. If this be the case, there must be some projectile force; but what that force is we know not. Admiting there is a propelling power that forces the matter of light from the sun to the planets, we must admit that it returns to its original source; or, denying this, that the sun suffers an irreparable loss: In admitting that the sun suffers an irreparable loss, we must abandon the received opinion relative to a just

balance that is preserved in the planetary system by attraction and centrifugal force; for the former being diminished by loss of matter on which attraction depends, and the latter operating with accumulated force, arising out of increase of matter and diminution of the counteracting force, must in the nature of those two powers, throw the planets out of their orbits into disorder.

Again, admitting of an unknown power propelling light from the sun to the different planets, and that it returns to its original source, we are forced to relinquish our opinion of attraction or gravitation. For it must be remembered, that if any power act with suitable force to project matter beyond the sphere of its own attraction, within that of another body, it is obvious the matter thus acted on, must in the nature of things be retained by the attraction of that body; and thus prevent a return to its original source. Hence I am induced to believe that every thing necessary for the general good and prosperity of the earth and its inhabitants, were originally provided, and exists necessarily on it; superceding entirely the necessity of the co operation of foreign agents. No principle of the earth can be increased or diminished; when they are apparently increased, they are not so, but merely developed or modified. Nothing can take place above changes and modifications.—For instance, if all the combustible matter upon the globe was collected and set on fire, the quantity of heat would not be increased one particle: the same existed ever since the creation of the world; but in a latent state. It must require the utmost stretch of imagination to account for all the heat and light that have been flowing from the sun to the earth since its creation. If those agents have been ac-

cumulating on our globe through such a vast space of time, I should be glad to understand why we are not able to discover an increasing or proportionate degree of their influence: so far from this being the case, we are not sensible of the least degree of additional light or heat in our globe, tho they have been apparently multiplying ever since its creation.——Do they return to their original source? by what power are they repelled? When the earth has left the sun beneath the horizon, we account for the change of temperature, by saying there is an abstraction of heat, but whither, and by what power it is conducted, we know not. Therefore, I say it is at least plausible, that all the light and heat which are employed in the various operations of nature, exist in the earth, and that the latter is developed by that illuminating matter called light of the sun; but as soon as the light is withdrawn, heat is precipitated and becomes latent.

It is in my view a far more plausible conjecture, that the sun is one of the appurtenances of the earth, than, that it is the centre of gravitation, and at the same time sustain unremitting loss of that matter, which, according to our views of attraction and gravitation, must have the least tendency to depart from the centre of gravity. The opinion is contradictory, and in short, we must actually disavow the established theories of attraction and gravitation, and embrace a more rational one, which supposes the earth was rendered equivalent originally to its own operations and productions, independent of any foreign aid; and seek some new theory, by which we may be extricated from our bewildered situation in the mazes of false systems of astronomy and philosophy, which are

the result of genius and ambition, put forth to explain the impenetrable darkness of nature.

Whatever may be the truth of this matter, I acknowledge my inability to develope it:—and tho I disavow my entire dependance on the received systems of astronomy and philosophy to satisfy enquiries into the mysteries of nature, yet I forbear to hazard a belief of what I am persuaded will be discovered and received in subsequent life, being a work solely of time, genius and ambition, a co-operation of which is alone adequate to accomplish.

With regard to light, its beneficial influence on animals and vegetables, a very pertinent question arises:—If light is so indispensibly necessary to animals and vegetables, how does it happen that the former may live without great inconvenience, in places where light is apparently excluded? This would utterly confute the foregoing position, if we were to confine our idea of the entire abstraction of light to the ordinary appearance of a dark room or the periodical absence of the sun: The argument would be conclusive and well founded, if we could produce absolute darkness. But it appears to me, that darkness is as much a negative quality as it relates to the entire exclusion of light, as cold is to the entire abstraction of heat. Therefore, I think we might with equal propriety allow, that light as well as heat, enters in, and combines with the densest bodies excepting those which are perfectly transparent; here is an exception, because, in this there is neither reflection, nor union of light with the body, as its parts are so disposed as to admit the light to pass unaltered as it flows from a luminous body. Light evidently possesses the property of

insinuating itself into the densest matter, displacing the latent heat contained in this matter and forcing it out in contact with the oxygen of the atmosphere; and if the light be sufficiently intense and its application be continued, combustion must be the result. Several experiments prove, to a complete removal of every doubt in my mind, the non-existence of calorific rays in the solar light.—The focus of a burning lens, tho it manifests the most fervent heat we are capable of collecting, does not warm the atmosphere in the least degree: but the few scattering emanations from a fire do. If we present a large double convex glass to the beams of the sun, and observe that point in the atmosphere where the rays after passing through the glass, converge and decussate to form the focus—tho these concentrated rays are sufficiently powerful to vitrify matter, which oppose the most obstinate resistance to the action of heat, yet it does not even warm the subtile atmosphere which we know is rarefiable by the least degree of heat issuing from a fire. This fact is easily ascertained by blowing smoke into the focus of the glass thus formed in the atmosphere, which does not ascend, which evidently it would do, if the air was at all heated.—Again, light acts more powerfully on those substances it has the strongest affinity for: and those matters may always be known by their color. Those objects that appear black, have the strongest affinity for light, since the whole of it is absorbed; hence combustion takes place in black objects by the influence of the solar light far more speedily than in those of any other color; yet the color of matter when subjected to the action of heat from a fire, does not influence it's combustibleness in the least degree. White

and transparent bodies are not acted upon by light of the sun:—heat acts not less powerfully on these than it does on colored bodies, of course the light of the sun contains no heat. White clothes are abundantly cooler in summer than black, if we are exposed to the rays of the sun; but to the emanations from a fire, we derive no advantage from color. These circumstances concur to prove that the solar light, by its diffusive and attractive powers, combines with matter, and extrudes the latent heat contained therein.—And that even admitting the light to be derived from that fiery luminary the sun, it is utterly destitute of those calorific rays which perform so distinguished a part among the operations of our globe.

It is by this diffusive agency of light that the vegetable kingdom is enlivened and invigorated by heat; for there is pretty uniformly sufficient accession of moisture to the plant to carry off by evaporation the superabundant heat extruded by an union of light with the plant; which prevents that parching of its extremities which occur in very warm and dry weather. The utility of light, independant of its property of extruding heat, is likewise manifested in its operation on all the vegetable creation. When deprived of this *pabulum vita*, they become weak, sickly and unwholesome; such as celery, cabbages, &c. Vegetables require only five of the component parts of light, since two are rejected by a large majority of them, viz. blue and yellow, which combine to form green; this being reflected to the eye (whence the greater part of vegetables are of this color) cannot be useful to the plant, or it would be absorbed with the other constituent parts of the solar light. There are but few vegetables which require all the rays of light for

their health and nourishment; as they would in that event uniformly assume a black appearance; which is a privation of all the colors which form light. Whatever be the color of a vegetable, those parts of the solar light which form that color are needless; otherwise it would not be reflected by the plant, whose reflection falling on the retina of the eye, excites an idea of the form and color of the plant, but on the contrary, had all the rays been absorbed, there would be no reflection, and consequently no color of the plant would appear. So indispensibly necessary is light to the health and strength of the vegetable kingdom, that it is universally sought after by them. A vine, confined in a dark room becomes weak, languid, unfruitful and tasteless. Feeling its great need of this vitalizing principle, it is known to exercise faculties, manifested in a sort of judgment or choice, in procuring this life giving element: when light is partially excluded and the vine enveloped in darkness excepting a small fissure in the opposite side of the apartment—it is observed to direct its course to that particular spot and make its exit through the aperture.—Light seems to form a component part of almost every substance upon the globe: it seems to accompany heat invariably. I imagine that light is present when the least degree of heat is developed, but so weak as not to make any impression on our organs of sight; for if we increase the heat, light then becomes visible. I am also of opinion that heat is not a visible substance; and we should never know the presence of it except by its effects and the light with which it is accompanied. It appears that bodies contain different proportions of light and heat, according to their capacities for receiving them. For in-

stance, the proportions of light and heat in oil and wood differ very widely: it would require a much greater degree of extruding force to develope sensible light in a given quantity of the latter substance than the former. What is commonly termed latent heat, I presume is composed of light; and the other constituent (for the sake of convenience) I will call caloric, these in a state of combination I believe to be totally inactive. Sensible heat seems to be compounded of the caloric of latent heat and oxygen; since we should be entirely ingnorant of the existence of such a substance except in its combination with oxygen. It appears that light and some invisible principle (which I have taken the liberty to call caloric) combine to form latent heat: and that these exist in a state of combination in all substances. The union of the caloric of latent heat and oxygen is necessary to produce active or sensible heat and light;—for if latent heat be extruded by any the most effectual means for that purpose, and it be done in an atmosphere deprived of oxygen, though it be completely developed, yet it remains insensible and inactive. In the act of combustion, it seems that the oxygen of the atmosphere unites to the caloric of latent heat that is contained in all matter, and forms sensible heat, part of which (or the excess that is rejected by the resistance of the combustible) and light, are set at liberty, and given out to surrounding objects: The balance combine with the body subjected to its action—and as heat tends universally to equilibrium, and is generated there by the process mentioned; it instantly flies off in every direction, and combines with all bodies of a lower temperature, in order to restore the balance, carrying with it such of the volatile constituents

of the combustible as are least adherent by the force of attraction, leaving the grosser or more fixed parts in the form of ashes. There appears to be a slow combustion progressing on the surface of all matter. The oxygen of the atmosphere in which all bodies are immersed, finds access to the caloric of the latent heat of matter, and by its union therewith, generates sensible heat; which being in small quantity, insensibly decomposes combustible matter, giving out insensible light at the same time. It is in this way I would account for the decomposition of animal and vegetable substances, which afford nourishment for the recomposition of others.—Heat and its dependencies being the analytic, and affinity, the synthetic powers of matter, without which it could assume no regular form. Light is not less active in diffusing its beneficent influence in the animal than vegetable kingdom. It has doubtless never yet entered the mind of man to conceive of any other plan than that already devised, so perfectly consonant to the harmony and happiness of man and other animals as they pass through the different scenes and changes of life. Not to mention the invigorating influence of light, it is what first suggests ideas to the mind; thereby rousing the genius and stimulating the faculty of thought, contributing to man excitement of invention, and a diligent and unwearied research after knowledge—all accomplished through the medium of the organ of sight, which is wonderfully fitted to the performance of its function.—The eye is composed of coats, humors, blood vessels, muscles and nerves. Over the interior surface of the third coat, is expanded the optic nerve, which has direct communication with the brain. This nerve by its extreme divi-

sion after passing through the foramen opiticum, is commodiously spread over a large surface for the purpose of receiving more extensively the impression of light, which is brought in immediate contact with its minute ramifications. The impression being made whilst a large surface of the nerve is exposed to the stimulus of light, is concentrated into the condensed substance thereof, when, according to our present knowledge of the nervous system, it is conveyed by sympathy to the medullary substance of the brain where it excites the idea of light:—And I think it no improbable conjecture that if any other nerve was equally exposed to the stimulus of light, the same impression would be made thereon,& the same idea thereby excited in our minds—And it seems equally obvious in the event that such glasses might be adapted as would effect vision in a very perfect manner. Now as the optic nerve being immediately exposed to the stimulus of light, or only covered by perfectly transparent coats and humors which oppose no obstacle to the passage of that subtile fluid; in variegated nature, we are struck with an infinitude of modifications in color, as well as consistence of matter that constituted the terrestrial globe whithersoever we direct our eyes—and it is evident that the idea of those modifications of color arise solely from different impressions made on the retina by light, reflected from the surface of different compositions of this matter.—The object only serving to reflect that light which is suited by the change it undergoes to make such an impression on our visual organ as will excite the idea of a particular color, or different appearance with regard to another body towards which we direct our eyes. Light undergoes a change as soon

as it falls upon the earth; and that chance happens in proportion to the different modifications of color:—for if some other principle than light was the means by which we perceived bodies, and it should undergo the same changes by the reflecting and refracting powers of matter, we should if it were visible, see what we call the color of the body in the reflected ray: This is to show in the plainest manner possible, that the numerous variety of shades and modifications of color, which delight the eye of the fanciful, reside exclusively in light.

The dyer can obtain only three original or primitive colors; with which by proper proportions he may form either of the prismatic colors. From this circumstance I infer, that the three dyes are the only fit compositions for reflecting three parts of the solar light, viz. Red, Blue and Yellow—and that different proportions of these three decompose or divide the light in such proportions as to reflect the other four parts; and further combinations and proportions all the different shades with which nature and the arts are adorned. The difference of color arises from various disposition of the particles of matter, whereby some of the rays are admitted, and others rejected; the latter unite and form a particular color, according to the different proportions of light rejected by the reflecting surface. For instance, if light in its ordinary state, fall on a surface whose particles are so arranged as to absorb all the component parts of light except blue and yellow; these will unite by their own affinity, and form a stimulating fluid, which, when applied to the retina excite motion or sensation there, which is called green. This subtile stimulating fluid, emanating from every part of the object in a straight line, must

make an impression on the retina of the eye, precisely similar in form to the object: So if the object be triangular, the green rays coming from every part of it in a straight line must make a triangular impression on the retina. The stimulus of the light in this case on the retina of the eye, may be compared to the stimulus of compression, or the sensation that would arise from the pressure of a hard substance of this form against any irritable part of the body—that part covered by the object, alone, feeling the stimulus of compression, and the compressed part being precisely in form of the compressing body, will readily convey an idea of this form.

It seems that transparency arises from a peculiar arrangement of the particles of matter, by which all the colors are admitted to pass unaltered, as they flow from a luminous body.—Hence al transparent bodies have the same appearance, and opake bodies exhibit different colors, according to the disposition of their parts, or affinity for some of the constituent parts of light; whereby a certain portion of it is absorbed; throwing off that which would not combine with the body, forming a particular color, distinguished by a bluish, redish, greenish, &c. according to the division of light, or excess of color, rejected by the reflecting surface. By this means our ideas of the form, color and texture of bodies are suggested and impressed on the mind. If light falls on an object whose parts are so disposed over its whole surface as to reflect only the red rays, these falling on the bottom of the eye applies there a peculiar stimulus, or excites different motions in the retina from any of the other component parts of light—this peculiar stimulus of light emitted from the object to the eye is called a red color of the object, which

idea is strongly suggested to the mind so long as we keep our eyes directed to the object.—But if the stimulus of the red rays should cease by the interposition of some other body, we retain an idea of the former body, or have a recurrence of it, by excluding every idea or stilling every motion or operation of the brain, save that which was induced by the peculiar stimulus of the red rays on the retina of the eye. This is termed memory—one of the faculties of the mind or brain, or a susceptibility of the same motions that were excited in it by stimuli—as perception, association, judgment, reason and volition; these being actual motions or operations of it, while memory, imagination, &c. are its faculties or aptitude of those motions. Light acts on the faculties thro the medium of the eye, producing those motions termed operations of the mind.

The brain is the noblest part of man; its susceptibility or aptitude of motion, or those motions that are called operations of the mind, arising from the stimulus of sound, light, &c. may be called excitability. The motions themselves, or operations, excitement, and the causes of those motions which act thro the medium of the senses, on the faculties, inducing the operations, may properly be called stimuli. It is the faculties of man that raise him so high above the brute creation—and it is obvious that these are the result of organization. If we apply the moving power of one machinery to another, tho it be built of the same materials, yet if constructed or organized differently, the motions or operations of the two would be very different. Thus the brute creation have the same external senses, or avenues to the brain, and the same stimuli to act thereon; but having different facul-

ties or excitability, on account of a difference of organization, the excitement or motions of their brain must differ accordingly. The eye is the noblest and nearest avenue to the brain: it seems that nine tenths of the motions of the brain (commonly called operations of the mind) are induced primarily by stimuli which find access thro this channel. Those who are destitute of the sense of vision, tho their other senses become more acute, and convey more correct information than they would otherwise do, yet the operations or excitement of the brain is vastly circumscribed, on account of the preclusion of that host of stimuli which act on the throne of life thro the channel of the eye.

When we consider the great variety of impressions or motions induced in the brain by light flowing from different objects, and the infinite variety of modifications it is susceptible of, and recollecting there can be no sensation without motion, and every modification of light produces a different motion, and every motion induced by light being an idea or operation of the mind, we can but express our astonishment at the vast and endless train of information this fluid is calculated to impart to the human race. Light is one of the most important stimuli which support life. It acts on the excitability and increases the circulation of the blood, for if it be applied to the eye in excess it produces inflammation; or pain, heat, redness and swelling, which symptoms characterize increased action of the vessels, and inflammation—The abstraction of light induces debility, and debility is the predisposing cause of sleep—hence this state is more easily induced in night than day—a periodical recurrence of night or darkness is necessary to accumulate or restore the excitability of the system, lost or worn down by the stimulus of light during the preceding day. Light acts on the irritability of the retina; and if in excess, impairs its action of motion similar to the action of undue stimuli on the excitability of the system generally—Stimuli which would induce hilarity and agreeable cheerfulness in one who had been

governed by the rules of temperance and moderation, would have no effect on the stupid Bacchanalian who has wasted his excitability by intemperate use of æther, laudanum, Cayenne pepper and Jamaica spirits.—Thus the light of a room which would effect perfect vision in a healthy eye, would have no effect on one exposed for several hours to the light of a clear day, reflected from snow: For all the rays being reflected and none absorbed by the snow, they act so powerfully on the retina as to wear down its excitability and none is left for weaker light to act on:—Hence, when we come into a house after being exposed to the powerful rays of the sun, we seem enveloped in darkness. If we view a piece of iron heated to a white heat, and turn our eyes away, we perceive a dark shade in form of the body heated—The excitability of that part of the retina on which the image of this luminous body was painted, being destroyed or wasted by excess of stimuli, while other parts of it remain healthy or retain their irritability, the part thus weakened by excess of light, consequently becomes insensible to the ordinary degree of it: of course if no impression is made on this part, and other parts of the retina be stimulated as usual, the weak part will induce a sensation of darkness.—By long continued motions of the brain, (arising from the stimulus of light applied in form of the image of objects) it acquires such an aptitude of the same motions, that they recur involuntarily, or independant of the re-application of the stimuli which first produced them: This is manifested in dreaming. The retina of the eye, likewise, take on the same motions involuntarily that were excited by repeated application of the image of an interesting object. This is frequently experienced in youth, after a successful day's sport of fishing; at night, when the eyes are shut, the same motions of the cork are distinctly perceived; which is an involuntary recurrence of the same motions that were induced on the retina by the image of the cork during the day.

I submit these observations and myself to the examination of the society. Tho' the dissertation is short, I have left a wide surface to act on: and should I prove insufficient to satisfy your inquiries into the truth of what I have suggested, then gentlemen I must court that liberality and benevolence which have ever char-

acterized this august body ; and on which I entirely relied or founded my hope of deliverance in such unhappy event.—Permit me to assure you that it is not my design, was I able, to confute the received opinion of others in relation to light ; for it is a subject so difficult, and involved in such profound mystery that I conceive it vain and fruitless to propose any thing more respecting it.—And I conceive it equally unprofitable to say more respecting the process of vision, as it would only be a recital, or repetition of that which has been long since discovered and recorded by ingenious writers.—I am therefore of opinion that we should avoid repetition and endeavor to project something new, how hazardous soever it may be, as it would probably tend to facilitate our progress in the acquisition of knowledge.

THE END.